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SCIENCE AND SURGERY

FROM the earliest ages, the functions of the brain have been a fascinating study to cultivated minds, and the greatest intellects of all ages have occupied themselves in attempting to solve its difficult and complicated problems. With the ancients this was a favourite pursuit, and engrossed the thoughts and talents of their most illustrious philosophers. Owing to the absence of exact methods of scientific observation and experiment, the conclusions on this subject were for many centuries of a purely speculative character, and the errors and fallacies thus deduced have been handed down and accepted till comparatively recent times. Modern investigations have, however, thrown a flood of light on the question, and although much still remains in the dark, the former obscurity has of late years been brightly illumined by the lamp of science. The accumulated clinical experience of ages had left knowledge on the cerebral functions in a state of confusion and uncertainty, and owing to the obvious difficulties and complications associated with disease, the results, however significant, were at best imperfect. That the brain should be subjected to direct physiological experiment was, until modern times, never attempted. During the last generation only has the practicability of this been demonstrated, and numerous observers have, by direct operations on the brain substance of animals, arrived at new conclusions as to its functions, and greatly revolutionised our ancient conceptions on the subject. Evidence has also been given against the *noli me tangere* theory, and abundant proof has been adduced of the fact that the brain may be handled, irritated, or partially destroyed without necessary danger to life. One of the latest developments of this method of investigation has been the discovery of those centres in the cortex which preside over voluntary motion, which have been, more especially by Prof. Ferrier, differentiated and localised with great precision. This important knowledge has been arrived at by an extended series of experiments conducted on living animals, in which, by observing the several effects of stimulating or destroying limited areas of their brains, the different functions of these special localities have been determined. A topography of the cerebrum has thus been constructed, in which the various faculties have been mapped out, but these, unlike the illogical visions of the phrenologists, have stood the test of sceptical criticism and rigid experimental inquiry. Researches of a purely scientific nature, carried out only with the object of elucidating truth and advancing knowledge, without immediate prospects of material gain, have in this instance led to most important and useful practical advantage. Armed with the knowledge acquired on animals in the laboratory, the physician has been enabled to utilise at the bedside the conclusions thus arrived at for the service of human beings. Clinical experience combined with morbid anatomy had already enabled the medical man to suspect the presence of disease in the brain, but as to its precise locality he was formerly in doubt. Now, however, guided by the recent revelations of physiology, he is enabled to predict the position in a large number of cases with great certainty and precision. Evidence of this is afforded by the proceeding adopted in a case of disease, notice of which has lately appeared in the medical papers. It appears that a man presented a series of symptoms which enabled Dr. Hughes Bennett to diagnose a tumour of the brain, that it involved its cortical substance, that it was probably of limited size, and that it was situated at a certain definite spot. The skull was trephined over the suspected region; there a tumour was found and removed. On recovering from the immediate effects of the operation the patient was and continued for three weeks in a satisfactory condition. He was perfectly intelligent, his functions, except for certain defects of motion caused by the disease, were normally performed, and there was an absence of all the distressing symptoms from which he had formerly suffered and from which he must necessarily soon have succumbed. Unfortunately, at the end of this time a complication, incident to all serious surgical operations, supervened, from which the patient ultimately died. The unhappy termination of this particular case does not in any way detract from the importance of the principles which it involves. It still remains a signal triumph of diagnostic accuracy, a precision mainly attained by exact experimental research. It is, moreover, further proof that by utilising this improved knowledge the surgeon may not only remove disease from the brain, but that he may do so without necessary shock or risk to the nervous system, and that the procedure, under modern antiseptic precautions, need not be attended with greater danger than may follow any other severe surgical injury. This interesting and instructive case will doubtless inaugurate a new era in medical practice, for although this particular individual has succumbed to measures adopted to avert his otherwise certain death, the experience thereby gained is sufficient to encourage further efforts in a similar direction which may prove beneficial to others. In the Marshall Hall oration of last year Prof. Ferrier remarked, "There are already signs that we are within measurable distance of the successful treatment by surgery of some of the most distressing and otherwise hopeless forms of intercranial disease, which will vie with the splendid achievements of abdominal surgery." He further added, reflecting on the success which had attended brain operations on animals, "I cannot but believe that similar results are capable of being achieved on man himself." That distinguished physiologist cannot but feel gratified that his prophetic words have been partially realised.

DE BARY'S "VEGETATIVE ORGANS OF THE PHANEROGAMS AND FERNS"

Comparative Anatomy of the Vegetative Organs of the Phanerogams and Ferns. By A. De Bary. Translated by F. O. Bower and D. H. Scott. (Oxford: Clarendon Press, 1884.)

IN 1861 a plan was drawn up in Germany to provide a series of hand-books or text-books on botany, which should treat of the science as it existed at the time; four of these books were completed, De Bary's "Vergleichende Anatomie der Vegetations-organe der Phanerogamen und Farne" (published in 1877) being one of them. This book, as is well known, proved to be a masterpiece of industrious research, accurate treatment of facts, and critical sifting of details; its influence soon became apparent, not only on the best teaching and text-books of our time, but also on those engaged in original research in various directions. This marked influence was not confined to Germany, but affected the teaching in this country also; and some of us were so fortunate as to come under that influence before more antiquated methods of treatment had rendered difficult the task of receiving the new impressions.

Mr. Bower and Dr. Scott have now prepared a translation of this treatise, and those best acquainted with the original will be foremost in congratulating them, not only for having placed the work in the hands of English workers and students, but also for the manner in which it has been accomplished.

In commenting upon the plan of the book, it should be borne in mind that the basis of classification is anatomy, and anatomy only, and this accounts for many peculiarities in the mode of treatment.

The introduction sets this forth clearly, and shows the kind of difficulties to be avoided in the scheme. Students will gain by carefully reading this able introductory portion, which contains an admirable account and criticism of the relations of the tissues to the meristem from which they are derived, and the vexed question as to the best mode of classifying the systems of tissue in mature parts. The great difficulty of course is in the case of what Sachs terms the "fundamental tissue"—*i.e.* the tissue which remains after the dermal tissue and fibro-vascular system have been removed. De Bary finds it necessary to cut this up into several forms and systems of tissues, as was to be expected from the mode of treatment. Sachs has lately again maintained that on the whole the "fundamental tissue" is best regarded as one system. This and other discussions as to the relative value of systems of tissues certainly owe much to the point of view started from, and it is not easy to see how De Bary could avoid the further dissection of the larger systems of tissues.

As matter of fact he is constrained to adopt six chief forms of tissue, various groupings of which constitute the systems of tissues. These are: (1) Cellular tissue (epidermis, cork, and parenchyma); (2) sclerenchyma; (3) secretory structures; (4) vessels (this word is *Tracheæ* in the German, and "vessels" does not express its intended meaning accurately); (5) sieve-tubes; (6) milk-tubes (*i.e.* laticiferous vessels). Intercellular spaces forming the subject of an appendix. This preliminary classification, as would be expected, presents difficulties here and there, and it will be seen that the structures designated "secretory" afford exercise for the utmost ingenuity in classifying them anatomically.

Having laid down the lines along which the plan of the work is to run, so far as these forms of tissue are concerned, De Bary then proceeds to review and criticise the views held as to the differentiation of the various groups of tissues from definite layers or portions of the meristem of the growing-point. Hanstein's classification into dermatogen, plerome, and pleriblem is well known, as is also the calyptrogen of Janczewski. We cannot here enter into details, but must refer the student to this excellent summary, merely stating that the facts do not allow of Hanstein's classification being extended to all the cases, though it must be admitted as true for very many. Nor have later investigators succeeded in establishing a system of classification of the tissues comparable to that of the animal embryologist. This of course complicates the matter, and accounts in part for the plan followed in the second part of the book, which treats of the arrangements of the forms of tissue referred to above, and of the changes in their primary arrangement brought about by secondary changes, *e.g.* growth in thickness, &c.

In Part I. the first chapter deals with cellular tissue, the portion concerned with the epidermis and its structure being particularly interesting and important. De Bary's account of the stomata has long been known, but many facts relating to those peculiar forms known as water-pores or water-stomata will be new to the student unacquainted with the original. The description of the cuticle and cuticularised layers of the outer walls of the epidermal cells, and the facts as to the occurrence of wax on their exterior are very important, and must afford the basis for all future work on these subjects. A striking example of De Bary's critical power and ability to deal broadly as well as in detail with large series of facts are evident in his remarks on those troublesome organs known as glands. It may well be doubted whether we shall ever have a satisfactory classification of the various "secretory structures" on anatomical grounds solely; it must be admitted, however, that the most satisfactory account of these bodies, as a whole, is given in the present book. De Bary limits the term gland to epidermal secretory organs—all others are to have definite names implying their different position, &c. This necessitates the separate treatment of reservoirs of secretions, and laticiferous vessels as contrasted with epidermal or dermal glands on the one hand, and intercellular spaces which contain secretions, &c., on the other; the difficulties arising from various causes are in part met and discussed, but there are some still outstanding.

Having treated of the forms of tissue in the first seven chapters, Part II. of the book commences with Chap. VIII. The first section (Chaps. VIII. to XIII.) is concerned with the primary arrangement of the forms of tissue. The vascular bundles are here dealt with in great detail from two points of view: (1) with reference to their course or distribution in the stems, leaves, and roots; and (2) as regards their structure. The first aspect of vascular bundles is almost unknown in England, and most teachers have ignored it altogether. It is important, however, and although they must not be ranked or compared with structures occurring in other organisms, we must not forget that the supporting and conducting systems of a higher plant are represented by its wood and tracheæ, while its sieve-tubes have equally important duties to perform. This being so, there is no less reason for studying the course and distribution of the vascular bundles (and the same remark applies to laticiferous vessels, reservoirs of secretion, and even strands of sclerenchyma) in a plant, than for tracing the distribution of the various conducting, supporting, and secreting tissues and organs in a higher animal. Already the investigations promise to bear fruit, as witness Koch's descriptions of the course and endings of sieve-tubes in the leaves, and also the various points of anatomy which throw light on the discussion as to the ascent of water in wood. No doubt it is too early to anticipate where these researches may lead; meanwhile every botanical student should learn the course of the vascular bundles in several typical plants, say, among others, *Lathyrus*, *Clematis*, a Palm, *Tradescantia*, a Fern such as *Aspidium*, and *Equisetum*. This should be done not only with reference to the distribution of these important structures, but also in order that the study of transverse sections may become something more than the impression of a pattern on the memory, as it too often is.

The bearing of these matters on the older views which confined the attention too much to the typical palm-type for the Monocotyledons, and to a few restricted examples of Dicotyledonous stems is obvious.

Some very important points exist also with reference to the structure of the vascular bundles, a matter which should be studied as De Bary studied it, in connection with the above. Students are seldom led to understand that the terminations and interconnections of vascular bundles often differ considerably from the enlarged portions of the bundles, or "bundle-trunks," as the translators term them. The classification of vascular bundles into collateral, concentric, and radial has become better known of late years; but even now too little attention is paid to the subject of the structure and development of the vascular-bundle system in roots. This should be all altered now, for it is difficult to imagine better guidance for teachers and students than is afforded by the work under review, and specialists will not be able to dispense with it.

Want of space prevents our entering further into some other weighty matters in this portion of the work. No doubt some difficulty will be felt by the uninitiated with regard to De Bary's treatment of the subject of sclerenchyma. The key to the difficulties consists in the fact that however convenient it may be to regard the sclerenchymatous fibres of the "hard-bast" as part of the "fibro-vascular" bundle, sclerenchyma may be regarded as a form of strengthening tissue which recurs in various positions, and may therefore be treated separately—that which occurs as strengthening tissue associated with the vascular bundles being called bast-fibres, and treated as part of the bundle (which then becomes "fibro-vascular") for no other reason than because it is convenient, and the name is an established one. Simple as the matter is when understood on anatomical grounds, we fear that confusion will still ensue from want of care in apprehending the state of the case; this will be due to no fault on the part of the translators, however, for the portions of the book dealing with these particulars leave little to be desired.

The second section of Part II., treating of the secondary changes produced in the arrangement of the tissues by growth in thickness, forms a part of the book which has had much influence on text-books since it was written. The account of the growth in thickness by means of a cambium zone is excellent, and should be carefully studied by every botanist. The concluding portions of the book are in some respects more adapted for the specialist than for the ordinary student, but we do not advise the latter to neglect them on that account; on the contrary, much of the foregoing information becomes clearer when contrasted with the more abnormal processes observed in the forms there treated of. The facts are somewhat more isolated, however, and can only become important in proportion as the earlier parts of the book are understood; moreover, work remains to be done among the more anomalous forms.

Enough has been written to show that no botanist will be able to dispense with the work, and it only remains to point out one or two faults in the translation, and perhaps to mention a few trivial matters which might have been put better. Such phrases as "a numerous group of large . . . cells (p. 21), "the morphologically lower leaf-surface" (p. 319), and "quite a few rows" (p. 372), are somewhat harsh, and result from the close rendering of the original; objection may also be taken to such employment of compounds as "air-and-water-containing" (p. 210) and "many-layered, chlorophyll-containing parenchyma" (p. 226). It is true that students of science who read much German find less difficulty from the recurrence of such forms in English than might be expected, but many will regard them as serious blemishes which render the book more difficult to read. *Commelyna* (p. 40) becomes "*Commelina*," subsequently (p. 270 *e.g.*) we believe the former is correct, the latter being the German spelling. "Equiseta" and "Gramina" (*e.g.* p. 213), and "*Orobanches*" (p. 384) are not elegant. The reference to Fig. 207 on p. 467 is wrong, that figure concerning *Cytisus*. No doubt the misprint stands for 209.

The translators are responsible for several terms which will be new to English botany, and we must admit our indebtedness to them for attempting to introduce definite English equivalents for such terms as "*Bündel-stämme*," "*Holz-stränge*," "*Neben-zellen*," and "*Ersatz-faserzellen*." Whether "bundle-trunks," "ligneous bundles," "subsidiary cells," and "intermediate cells" respectively will be generally accepted as the equivalents in English remains to be seen. Personally we regard them with favour, as serviceable representatives of terms which have their uses. However, we can do no more here than congratulate the translators on having placed one of the most important scientific works of the day in the hands of British botanists in a satisfactory form; and we no less heartily congratulate those botanists who have been debarred from reading it in the original German on the rich store so well placed before them.

OUR BOOK SHELF

The Solar System. By Ernest R. G. Groth, M.D. Pp. 34. (London: John Bale and Sons, 1884.)

THIS book contains a very imperfect account of the nebular hypothesis of Laplace and Kant, with certain variations which must be incorrect, because they violate mechanical principles, and with certain speculations which are valueless because they are based on mere imagination.

The author does not realise the relativity of force and motion, for on p. 9 he asks: "If a body be acted upon by no force, why should it move at all?"

On p. 11 we learn how axial rotation originates when a nebular mass revolves orbitally about a centre of force. The explanation depends on the different orbital motion of the nearer and further parts of the nebular planet. As far as this goes it should, when properly applied, give us